

## FRAME FOR SEMICONDUCTOR PACKAGE

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

[0001] The present invention relates to a frame for semiconductor package in which a semiconductor device is mounted on a lead frame and the outside thereof, particularly the upper surface of semiconductor device is encapsulated with molding compound.

#### 2. Description of the Prior Art

[0002] In recent years, it has been required to miniaturize and shape semiconductor product mounted on a substrate thinner, as packaging of semiconductor is made denser. It has been severely required for LSI to reduce the number of chips by improving integration level and to miniaturize and make a package lighter. The popularization of so-called CSP (Chip Size Package) is rapidly advancing. Particularly, in the development of thin semiconductor product with lead frame, the semiconductor package of single side encapsulation type has been developed in which a semiconductor device is mounted on a lead frame and the surface of semiconductor device mounted on a lead frame is encapsulated with molding compound.

[0003] Fig. 1 is a sectional view of one example of semiconductor package. Fig. 2 is a plan view thereof. The semiconductor package shown in Figs. 1 and 2 is comprised of a lead frame 1, a semiconductor device 4 mounted on die-pad 3 supported with suspending leads 2 of lead frame 1, metallic thin wires 6 electrically connecting electrodes provided on the top face of the semiconductor device 4 with

terminals 5 of lead frame 1, respectively and molding compound 7 for encapsulating the outside region of semiconductor device 4 including the upper side of semiconductor device 4 and the lower side of die-pad 3. The semiconductor package is of non-lead type in which so-called outer leads are not projected from the semiconductor package and the two of inner leads and outer leads are integrated into terminals 5, wherein used lead frame 1 is half-cut by etching in such a manner that die-pad 3 is positioned higher than terminals 5. Since such a step is formed between die pads 3 and terminals 5, molding compound 7 can be inserted into the lower side of die-pad 3 so that a thin semiconductor package can be realized even though the semiconductor package has non-exposed die-pad.

[0004] Since semiconductor device is miniature, a matrix type frame is mainly used for the above-mentioned semiconductor package of non-lead type, in which plural semiconductor devices are arranged in a direction of a width of the matrix type frame. Further, recently, from a demand for cost down, it is thought to switch over a frame of individually molding type shown in Fig. 3 to a frame of collectively molding type shown in Fig.4.

[0005] In the frame of individually molding type, as shown in Fig. 3(A), individual molding cavities C of small size are provided separately within a frame F. After molding, individual semiconductor packages are stamped out so that semiconductor packages S shown in Fig. 3(B) are obtained. Namely, semiconductor devices are mounted on die-pads of lead frames through silver paste and others, and

wire bonding is carried out. Thereafter, respective semiconductor devices are individually molded with molding compound and the respective molded semiconductor devices are stamped out to form individual semiconductor packages.

[0006] In the frame of collectively molding type, as shown in Fig. 4(A), some molding cavities C of large size are provided within a frame F. Multiple semiconductor devices are arranged in matrix within each molding cavity C, respectively and collectively molded with molding compound. Thereafter, the collectively molded semiconductor devices are cut at grid-leads L by means of dicing saw so that a semiconductor package S shown in Fig. 4(B) is obtained. Namely, semiconductor devices are mounted on die-pads of lead frames through silver pastes and others and wire bonding is carried out. Thereafter, plural semiconductor devices arranged are collectively molded with molding compound to a given cavity size, and then the collectively molded semiconductor devices are cut to form individual semiconductor packages by dicing.

[0007] In the above-mentioned semiconductor package of collectively molding type, plural semiconductor devices are arranged in matrix and collectively molded with molding compound. Thereafter, the collectively molded semiconductor devices are divided into individual semiconductor packages. In this case, the collectively molded semiconductor devices are cut at grid-leads by means of dicing saw, while terminals of lead frame are cut off from grid-leads.

[0008] Generally, in case of producing products by etching, parts designed to form a right angle are finished

to have roundish shape (R-shape), no matter how etching process is carried out. In a frame for semiconductor package of collectively molding type, even if connecting parts of grid-leads L with terminals 5 of lead frame is designed to form a right angle, products cannot be obtained as designed, etched products have R-shape as shown in Fig. 5. Further, as shown by the dotted line in Fig. 6, cut surfaces of terminals 5 of lead frame exposed in cut surface of molded resin 7 in individual semiconductor packages formed by dividing the collectively molded semiconductor devices at cut line  $\alpha$  by dicing becomes larger to approach to each other, in a case where larger R-shape is formed at the roots of terminals 5. Accordingly, a problem arises that accident of short circuit is caused by soldered bridge.

#### BRIEF SUMMARY OF THE INVENTION

[0009] An object of the present invention is to provide a frame for semiconductor package of collectively molding type used for the production of semiconductor package, in which accidents as soldered bridge are prevented.

[0010] In order to achieve the above-mentioned object, a first type of frame for semiconductor package of the present invention comprises plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor devices are mounted on die-pads supported with suspending leads of individual lead frames, the semiconductor devices are collectively molded with molding compound, and the collectively molded semiconductor devices

are cut into individual semiconductor packages at grid-frames, wherein thin parts are formed in areas corresponding to neighborhood of the roots of individual terminals, the thin parts being formed by half-cutting by etching metal of the areas from the front or back thereof.

[0011] Further, a second type of frame for semiconductor package of the present invention comprises plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor devices are mounted on die-pads supported with suspending leads of individual lead frames, the semiconductor devices are collectively molded with molding compound, and the collectively molded semiconductor devices are cut into individual semiconductor packages at grid-frames, wherein hollows are formed in areas corresponding to neighborhood of the roots of individual terminals.

#### BREIF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is a sectional view of one example of semiconductor package.

[0013] Fig. 2 is a plan view of semiconductor package shown in Fig. 1.

[0014] Fig. 3 is an explanatory view of a frame of individually molding type.

[0015] Fig. 4 is an explanatory view of a frame of collectively molding type.

[0016] Fig. 5 is an explanatory view of R-shape generated by etching.

[0017] Fig. 6 is an explanatory view showing a state where terminals are exposed in cut surface of collectively molded semiconductor devices.

[0018] Fig. 7 is a plan view of one example of a first type of frame for semiconductor package of the present invention.

[0019] Fig. 8 is a partial enlarged view of the frame shown in Fig.7.

[0020] Fig. 9 is a sectional view taken on line A-A in Fig. 8.

[0021] Fig. 10 is a partial enlarged plan view of one example of a second type of frame for semiconductor package of the present invention.

[0022] Fig. 11 is a partial enlarged plan view of another example of second type of frame for semiconductor package of the present invention.

#### DETAILED DESCRIPTION

[0023] Then, referring to figures, embodiments of the present inventions are explained. Fig. 7 is a plan view of one example of first type of a frame for semiconductor package of the present invention. Fig. 8 is a partial enlarged plan view of the frame shown in Fig. 7. Fig. 9 is a sectional view taken on line A-A in Fig.8.

[0024] In these figures, F designates a metal frame for lead frames, in which lead frames 10 are arranged in a matrix of  $3 \times 4$  through grid-leads L. The grid-leads L connect terminals 11 of adjacent lead frames 10 with each other. As shown in Figs. 8 and 9, areas including neighborhood of the roots of terminals connected with grid-

leads L are provided with thin parts 11 which are formed by half-cutting by etching the metal of the areas. The thin parts 11 are formed to the outside of cut line  $\alpha$  cut by means of dicing saw. Therefore, even if R-shapes are generated at the roots of terminals 5, R becomes smaller by an extent of that the thickness of metal of the areas is decreased, as compared with that of the areas being not half-cut by etching. Accordingly, sectional area of terminals 5 cannot be increased at cut lines  $\alpha$ .

[0025] Process for producing semiconductor packages using the frame F is as follows. First, semiconductor devices are mounted on die-pads 3 of the respective lead frames 10 of frame F through silver pastes and wire bonding is made between terminals 5 of lead frames and electrodes provided on the top face of semiconductor devices. Thereafter, twelve semiconductor devices are collectively molded with molding compound to a given cavity size and then the collectively molded semiconductor devices are cut at grid-leads L by means of dicing saw in such a manner that terminals 5 of individual lead frames are left, by which the collectively molded semiconductor devices are divided into individual semiconductor packages.

[0026] In the individual frame for semiconductor package produced, area of terminals 5 exposed in cut surface of mounted resin cannot be increased. Accordingly, sufficient intervals are kept between adjacent terminals 5, in such an extent that accidents such as soldered bridge are prevented.

[0027] In the above-mentioned example, half-cut parts are formed on the front side at neighborhood of the roots

of terminals connected with grid leads. However, even if half-cut parts are formed on the backside by half-cutting by etching metal from the backside, the half-cut parts formed on the backside have the same effect.

[0028] Fig. 10 is a partial enlarged plan view of one example of second type of frame for semiconductor package of the present invention.

[0029] The frame is provided with hollows 12 having angular shape at neighborhood of the roots of terminals 5. The hollows 12 are formed to the outside of cut line. If hollows 12 having such a shape are provided at the roots of terminals 5, problems caused by R-shape formed at the roots of terminals by etching are solved. Accordingly, sectional areas of terminals 5 are not increased.

[0030] Fig. 11 is a partial enlarged plan view of another example of second type of frame for semiconductor package of the present invention.

[0031] The frame has round hollows 12 at the roots of terminals 5. The hollows 12 are formed in such a manner that the hollows cut into a part of grid-leads L from cut line  $\alpha$  along which the frame is cut. In case where hollows 12 having such a shape are provided at the roots of terminals 5, problems caused by R-shape formed at the roots of terminals by etching are also solved. Accordingly, sectional areas of terminals 5 are not increased.

[0032] In case of semiconductor package produced using a second type of frame as shown in Figs. 10 and 11, sectional areas of terminals exposed at cut surface of molded resin does not become larger, so that intervals between adjacent



terminals 5 are sufficiently kept. Accordingly, accidents such as soldered bridge do not occur.

[0033] As above-mentioned, a frame for semiconductor package of the present invention comprises plural lead frames arranged in matrix through grid-leads, the grid-leads having terminals projected from the grid-leads, in which respective semiconductor devices are mounted on die-pads supported with suspending leads of individual lead frames, the semiconductor devices are collectively molded with molding compound, and the collectively molded semiconductor devices are cut into individual semiconductor packages at grid-frames, wherein thin parts are formed in areas corresponding to neighborhood of the roots of individual terminals, the thin roots being formed by half-cutting by etching metal of the areas from the front or back thereof. Or hollows are formed in areas corresponding to neighborhood of the roots of individual terminals. Accordingly, it is inhibited that increased sectional area of terminals is formed, so that intervals between adjacent terminals 5 are sufficiently kept. Accordingly, accidents such as soldered bridge do not occur.